MPA material matters

September 2007

Newsletter of the Materials Physics and Applications Division

Hosemann recognized for distinguished performance

Contributions benefit Laboratory's Advanced Fuel Cycle Initiative

Peter Hosemann, center, receives his award from Principal Associate Director Science, Technology and Engineering Terry Wallace (left) and Student Liaison Carol Hogsett (right).

MPA-10 Graduate Research Assistant Peter Hosemann is the 2007 recipient of the Student Distinguished Performance Award. Recognized for contributing significantly to several aspects of the Laboratory's Advanced Fuel Cycle Initiative (AFCI) he received the award at the recent Student Symposium Banquet.

Hosemann, a doctoral student from the University of Leoben in Austria, has been working on his dissertation at the Laboratory since 2005, studying radiation effects on steels in a heavy liquid metal environment. His research is supported by the Global Nuclear Energy Partnership program.

In support of the AFCI project he has designed, modeled, assembled, and performed pioneering experiments at the Ion Beam Materials Laboratory to study irradiation effects on corrosion; systematically tested and characterized large arrays of surface-treated, alloy-modified, and coated specimens tested in heavy liquid metal coolant in DELTA, a medium-scale forced

"Hosemann" continued on page 4

David Watkins selected as MPA Deputy Division Leader

After a long and competitive search and selection process David Watkins has been named the new MPA Deputy Division Leader. Watkins comes to MPA from the LDRD (Laboratory Directed Research and Development) Program Office. "The LDRD Program is one of the most important resources the Laboratory has for innovative research and development, and it was a privilege to manage that effort." Watkins said. "MPA Division's notable LDRD accomplishments and efforts, plus my past experience with people in MPA, made the Deputy Division Leader position extremely attractive."

A principal focus of his initial efforts will be energy program strategic planning and implementation, working in partnership with the relevant internal and external program offices, MPA management and staff, and ADEPS divisions. "I can think of no more important and positive contribution that Los Alamos could make to national security than to provide environmentally sound solutions to world-wide energy problems," he said. Watkins will sit in the MPA Division Office in the old Administration Building but will also be available for meetings in the former office suite in the Materials Science Laboratory building. He can be reached through the Division Office at 5-1131 or at watkins@lanl.gov.

David Watkins

In other news regarding the Experimental Physical Sciences Directorate leadership team, MST Division Leader Paul Follansbee recently announced Alan Patterson has been selected as the MST Deputy Division Leader and P Division Leader Jack Shlachter announced Doug Fulton as P Deputy Division Leader. As his first DDL assignment Patterson has been asked to move to TA-55 and assume leadership of MST-16. This is a temporary assignment—designed to continue to integrate MST-16 into MST Division, to strengthen the program/line interactions, and to understand the unique working environment at TA-55. Rollin Lakis continues to serve MST-16 as Deputy Group Leader. Fulton has principal leadership of the dynamic model validation capability and assumes responsibility for the weapons science campaigns and inertial confinement fusion efforts across the directorate.

INSIDE this issue

From John's desk

MPA: Clarity and focus in a time of uncertainty

In talking to a number of you, I'm well aware that there is a great deal of uncertainty at the Laboratory at the moment and that uncertainty can contribute to stress and anxiety.

My knowledge of the workforce restructuring process is comparable to yours (and very limited). While I don't know all the details, I can assure you that Director Anastasio has been very clear with all levels of management that treating all employees fairly, transparently, and objectively is our highest priority. In addition, he's also clear that while we're working various exercises and planning scenarios, we have not made any decisions nor specific plans to reduce the size of the workforce. I'm confident that we'll continue to get appropriate updates as the process evolves.

In the meantime, the work we do remains an important priority for the institution. Continuing to contribute to the Laboratory's mission success safely and securely should remain our focus. If you have specific questions about workforce restructuring, please don't hesitate to ask me or your group leaders. Even if we don't know the answer, we commit to tell you what we do and don't know and will strive to get you the most complete information we have.

Especially in times of uncertainty, keeping an eye focused on long-term strategic priorities is essential for on-going success, and a robust capability model is an important element of our future strategy.

Also, please look out for yourself and your colleagues. If stress and anxiety are becoming overwhelming, please access the many resources that are available at the Laboratory such as the Employee Assistance Program (http://int.lanl.gov/health/eap/), the Ombuds Office (http://www.lanl.gov/orgs/ombuds/), and our human resources staff.

While budgetary uncertainty remains as we look towards FY08 (and this is a principal driver for workforce restructuring considerations), I'm happy to report that we have every indication that we will close FY07 successfully and that our best estimates forecast ~ 10% growth for MPA Division in FY08, similar to our growth in FY07. I personally appreciate your efforts in both reducing expenses and appropriately charging costs; these efforts contribute significantly to our fiscal health.

Prior to your October 11 paycheck, you will receive from your group leader both your performance summary for the last year and your new salary for the year to come. This year the process for raise determination is different—with a spreadsheet based on your current salary's position to market and your relative performance score determining your recommended salary increase. While the process has changed, I'm confident that your group leaders have given this very important activity the attention and effort it deserves. If in the end you have questions or concerns, please raise them with me or your group leaders.

I want to close on two positive and forward-looking notes. First, it's a pleasure to welcome David Watkins to the Division Office as Deputy Division Leader. David brings many valuable insights and experiences to MPA, and we're already profiting from his day to day impact. I also know that he's anxious to meet all of you; please don't hesitate to reach out to him and include him in your next group meeting or function.

Second, I'm looking forward to getting your feedback in the very near future on a new capability model that we have been developing with your group leaders. Having a clear sense of one's strengths and uniqueness helps to define who we are as an organization. Especially in times of uncertainty, keeping an eye focused on long-term strategic priorities is essential for on-going success, and a robust capability model is an important element of our future strategy.

—Materials Physics and Applications Division Leader John Sarrao

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contact Editor Karen Kippen,
MPA Communications,
at 606-1822, or kkippen@lanl.gov.

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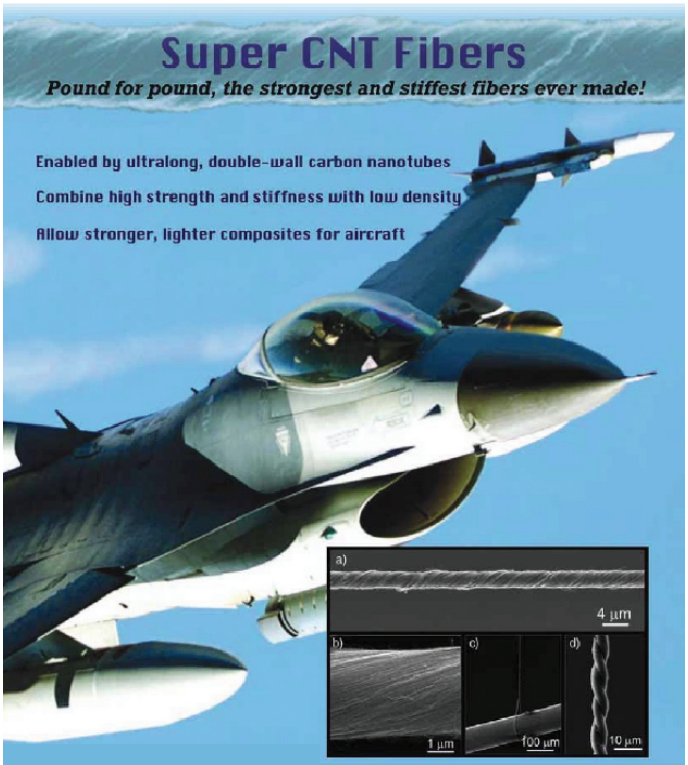
Super carbon nanotube fibers selected in MICRO/NANO 25 competition



Inset: Scanning electron micrographs of (a) super CNT fiber at low magnification, b) fiber at high magnification, c) fiber looped around a nickel wire and twisted (to demonstrate fiber flexibility and strength), and d) the twisted two-ply section of the fiber in (c).

The editors of R&D Magazine and MICRO/NANO Newsletter selected the super carbon nanotube (CNT) fiber invention as one of the most innovative products of 2007 in the Inaugural MICRO/NANO 25 Competition. An article on this year's winners appeared in the July issue of *MICRO/NANO Newsletter* and the August issue of *R&D Magazine*.

An independent panel selected the winners based upon: uniqueness of the technology, innovation involved in development, potential value the technology provides to an industry or society, the performance that the technology exemplifies, creation of new intellectual property, and comparison to existing technologies.

Spun from carbon nanotubes—the strongest, stiffest material known—the super CNT fibers that MPA-STC invented have one-tenth the density and four to five times the specific strength (strength per density) and specific stiffness (stiffness per density) of the best carbon fibers now used to make advanced structural compositions. This superior performance is achieved by spinning the super CNT fibers from ultralong (~1 mm) carbon nanotubes that have only two walls and a hollow center, giving them low density. A potential application of CNT is to enhance the performance of advanced carbon-fiber structural composites, which are used in aircraft, spacecraft, cars, and sports equipment.

Former MPA-11 graduate research associate concludes doctoral work on material degradation studies of PEM fuel cells

David L. Wood has successfully defended his PhD at the University of New Mexico. He was a member of the MPA-11 fuel cell team and recently finished his fourth year as a post-master's graduate research associate. Wood's dissertation research focused on elucidation of key degradation mechanisms, development of accelerated testing methods, and comprehensive PEM fuel cell durability testing.

Wood began working at Cabot Fuel Cells in Albuquerque in July.

While at Los Alamos, he won the inaugural Best Poster Award Contest at the 2004 Fuel Cell Seminar; was a member of the fuel cell durability team, which was honored at the 2005 DOE Office of Hydrogen, Fuel Cells and Infrastructure Technologies Annual Merit and Peer Review for the most significant research and development contribution of the year; and was selected for an honorable mention for the 2005 Dr. Bernard S. Baker Student Award for Fuel Cell Research, presented at the 2005 Fuel Cell Seminar.

David Wood

Prior to Los Alamos, Wood was from 2000 to 2002 the North American key account and technical service manager for the SGL Carbon Group fuel cell team in Meitingen, Germany. SGL Carbon is a leading developer of molded polymer-composite bipolar plates, rolled GDL (gas diffusion layer) substrates, and fully processed GDL materials. While there, he held an executive member seat on the US Fuel Cell Council and was a successor planning selectee.

From 1997 to 2000, he was an R&D project engineer on the General Motors fuel cell team, responsible for all aspects of internal and external GDL R&D and production, stack materials engineering and development, test engineering, novel characterization methods, and experiment design.

Wood received his MS in chemical engineering from the University of Kansas in 1998 and his BS in chemical engineering from North Carolina State University in 1994.

He holds three patents, has published five peer-reviewed papers, and has authored/co-authored 20 conference presentations in various areas of PEM fuel cell research.

Heads UP, MPA!

New MPA cyber security representative

Ray Tyler is temporarily acting as the MPA cyber security representative for MPA Division, replacing Mitch Richards, who has left the Laboratory. Tyler can be reached at 4-0498.

Tag your bag!

When untagged personal belongings are found in public places at the Laboratory, they are assumed to be and are treated as hazardous devices. They may be destroyed by the Hazardous Devices Team if the owner cannot be located.

Although the contents of a bag or package may be harmless, the building where it is found usually has to be evacuated. Evacuations are costly, time-consuming, and disruptive on institutional, organizational, and personal levels.

To learn more about tagging your personal belongings, see the recent *Security Smart* publication at http://int.lanl.gov/security/documents/security-smart/bagtags9_07.pdf.

Reproductive Health Assistance Program available for Laboratory employees

The Laboratory's Reproductive Health Assistance Program (RHAP) helps employees become fully informed about occupational conditions that may affect their reproductive health.

The program can help employees who are planning a family by addressing workplace questions and decisions. RHAP assists both male and female workers to make informed decisions regarding their reproductive health, said Rubén Rangel of Radiation Protection Technical Support (RP-3). The Reproductive Health Assistance Program is an integrated process supported by Occupational Medicine (OM-DO), Health Physics Operations (RP-1), Radiation Protection Technical Support (RP-3), and Industrial Hygiene and Safety (IHS).

For more information, see http://int.lanl.gov/safety/radiation/rhap.shtml.

Ensure devices with wireless capabilities are disabled

During a recent Los Alamos Site Office security survey, it was discovered that some computing and printing devices in Laboratory work areas have wireless capabilities, such as Bluetooth, that are enabled.

Chief Security Officer Division Leader Roger Hagengruber reminds employees that it is against Laboratory policy to use this type of technology on Lab property, including leased space.

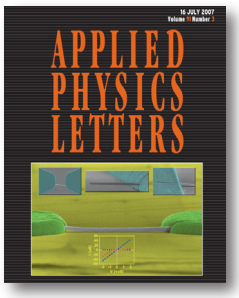
"We are asking each employee who has a computing device or printing device that has the capability to work through a WI-FI or Bluetooth connection, to immediately confirm it is disabled," said Hagengruber, noting that an employee's system administrator can assist in this effort.

"We will be conducting follow on reviews to insure the wireless capability has been disabled," he added.

For guidance on disabling Bluetooth at the Laboratory, see http://int.lanl.gov/news/newsbulletin/pdf/bluetooth.pdf.

Heads UP, MPA! reports on environment, safety, and health, security, and facility-related news and information.

Los Alamos-Sandia CINT collaborative research on cover of *Applied Physics Letters*



Work done by researchers in the Center for Integrated Nanotechnology was featured on the July 16 cover of *Applied Physics Letters*.

In "Directed assembly of nanowire contacts using electrodeposition," a maskless process for the directed assembly of Ni contacts to Si nanowires on prepatterned electrodes was reported.

The approach provides a parallel, maskless method to establish metal contacts to the nanowires without the need of high resolution electron beam lithography for electrical and mechanical applications.

This work involves a collaboration between CINT scientists Tom Picraux at Los Alamos National Laboratory and Sean Hearne at Sandia National Laboratories and Picraux's students Sarang Ingole and Pavan Aella at Arizona State University. It is part of a CINT user agreement on doped SiGe nanowires for functional nanodevices, of which ASU professor Stephen Goodnick is principal investigator and research faculty member Clarence Tracy is collaborator.

"Hosemann"

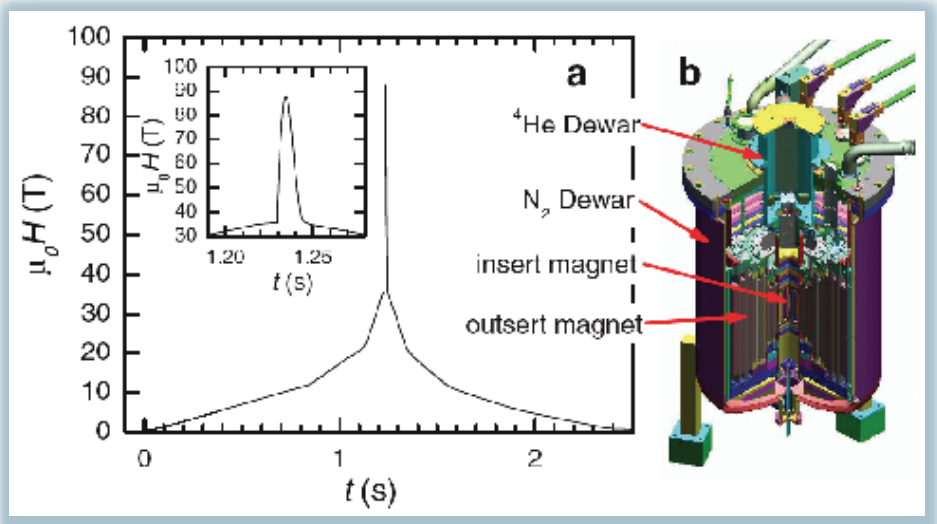
Continued from page 1

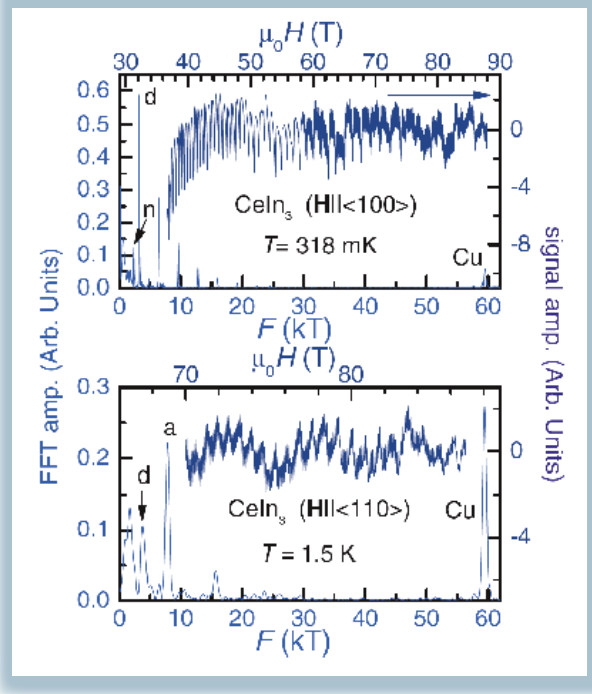
circulation lead-bismuth eutectic loop. Working with staff scientists, Hosemann developed a number of innovative materials characterization methods using atomic force and magnetic force microscopes, and nano-scale sample fabrication with focused ion beams, in the analysis of oxide structures and transport properties for refinement of oxide growth models.

Using the world's most powerful magnet to strip away correlations in unconventional superconductors

Scientists and engineers at the National High Magnetic Field Laboratory's Pulsed Field Facility at LANL have made an enormous leap forward in generating high magnetic fields and using them to study quantum matter under extreme conditions. The recently commissioned 100 Tesla Multi-shot Magnet—thus far delivering magnetic fields as large as 90 tesla, the highest magnetic fields ever non-destructively and repetitively generated—pushes back the frontier of experimentally accessible magnetic fields for low temperature physics experiments by approximately 25 tesla. The technology to generate non-destructive magnetic fields of 90 tesla requires the electromechanical properties of the construction materials to be pushed close to their limits—the energy-density and power-flow into the center of the magnet are comparable to the combustion chamber of a rocket engine. Remarkably, in spite of these extreme energy densities, scientists were able to perform ultra-sensitive experiments on metallic $CeIn_3$ at temperatures within the magnet bore of significantly less than 1 K (close to absolute zero)—conditions which were crucial to detect small signals associated with the rearrangement of the quantum levels of electrons in this material.

$CeIn_3$ is an example of a "strongly correlated" antiferromagnet in which the f-electrons of cerium participate both in magnetism and the electrical conducting properties of the metal. While such dual behavior may be key in the creation of unconventional superconductivity (including the high temperature superconductors and actinide superconductors such as $PuCoGa_5$), it is extremely challenging to understand. $CeIn_3$ itself becomes superconducting under high pressure when f-electron magnetism is suppressed. By aligning the f-electron spins above 60 tesla, very strong magnetic fields strip away their ability to participate in magnetism or superconductivity, thus uncovering the underlying metallic state in its most rudimentary form. (above, left). This high magnetic field metallic state is significantly different from that observed at high pressures when the material superconducts, and provides an essential simplifying step to help understand how electronic structure relates to the origin of superconductivity. Results from these seminal experiments on $CeIn_3$ appear in *Physical Review Letters,* **99** (2007).





Above: a) The H-versus-time T profile of the pulse generated by the combined "outsert" and "insert" magnets. The inset shows the region of the pulse profile provided by the insert magnet in which dHvA measures in figure at left are made. b) A schematic of the magnet used for generating the pulse (outer diameter ~ 1.4 m).

At left: Examples of dHvA signal measurements on CeIn3 for two different orientations of H together with Fourier transformations. The Cu signal originates from the polycrystalline Cu comprising the detection coils.

Authors are Neil Harrison, Chuck Mielke, Alan Paris, Mike Gordon, Chuck Swenson, Dwight Rickel, Patrick Ruminer, Josef Schillig, and Alex Lacerda, all MPA-NHMFL; James Sims, AET-1; Manual Pacheco, MSS-WC; S. Sebastian, University of Cambridge; M.-T. Suzuki and H. Harima, Kobe University; and T. Ebihara, Shizuoka University.

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